Metal abundances survey of A-type Stars in Herschel DEBRIS

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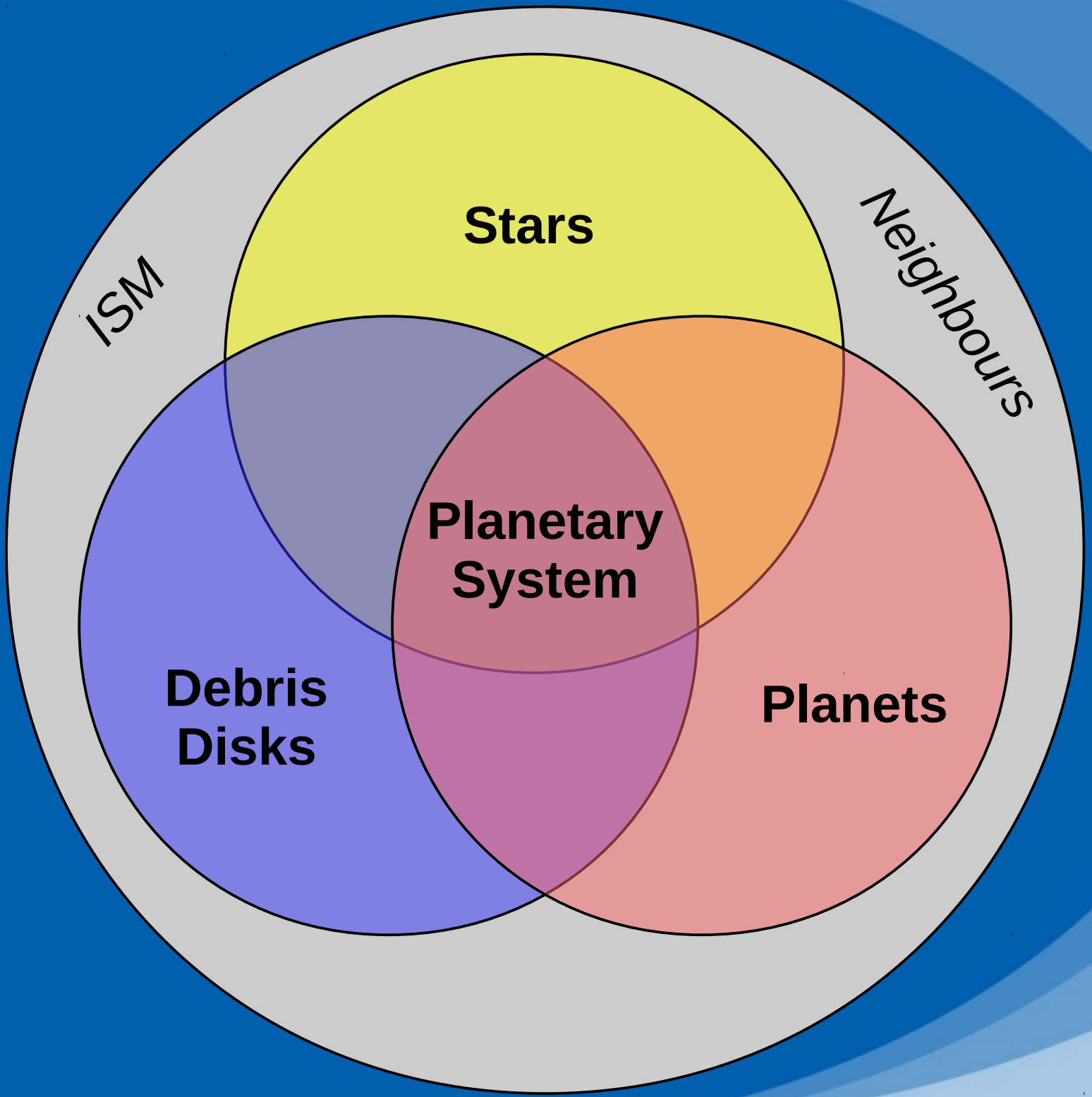

ISM
Stars
Neighbours
Planetary System
Debris Disks
Planets

A-type?

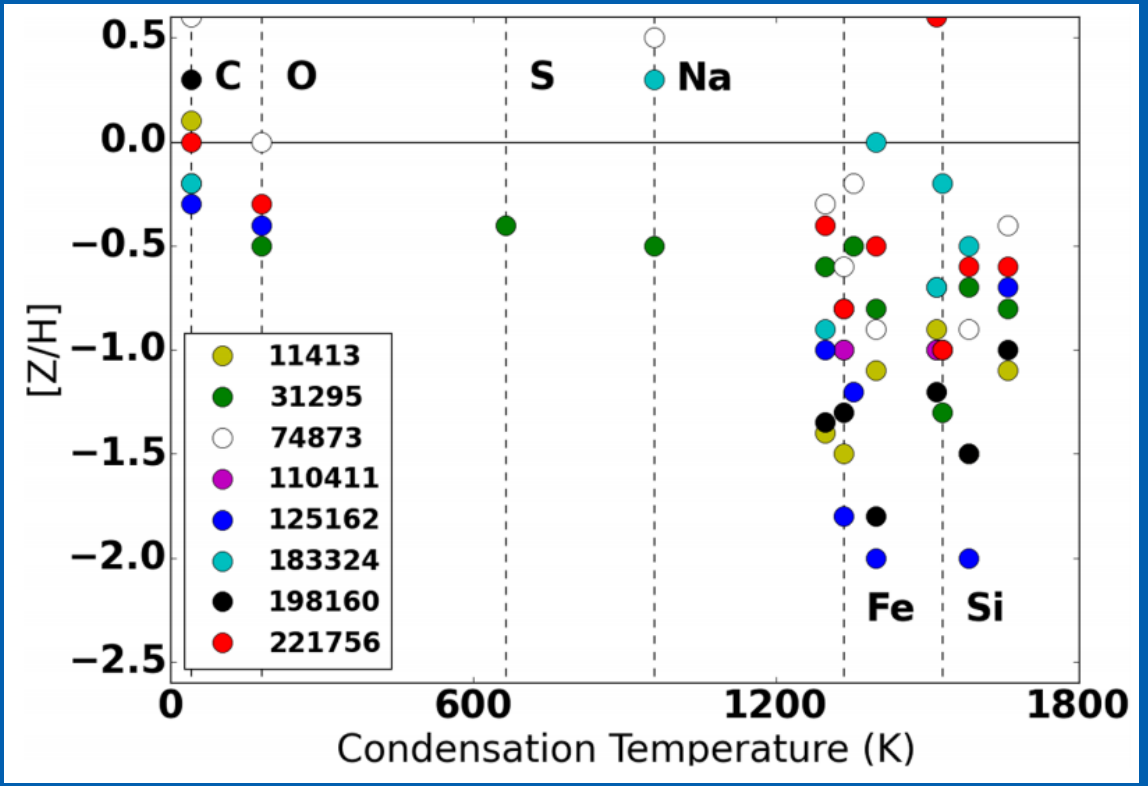
There be monsters!

Reasons A-types are the worst:

- Very few metal lines to measure.
- NLTE effects can be significant.
- Balmer lines are strong and exceptionally broad.
- Rotational velocities: cause metal lines blend into lines of other species.
  - Sometimes high enough to blend lines into the continuum.
- Non-convective surface makes the surface abundances not representative of stellar metallicity.

Lambda Boo Phenomenon

Volatile /
Gas Phase



Draper 2016a

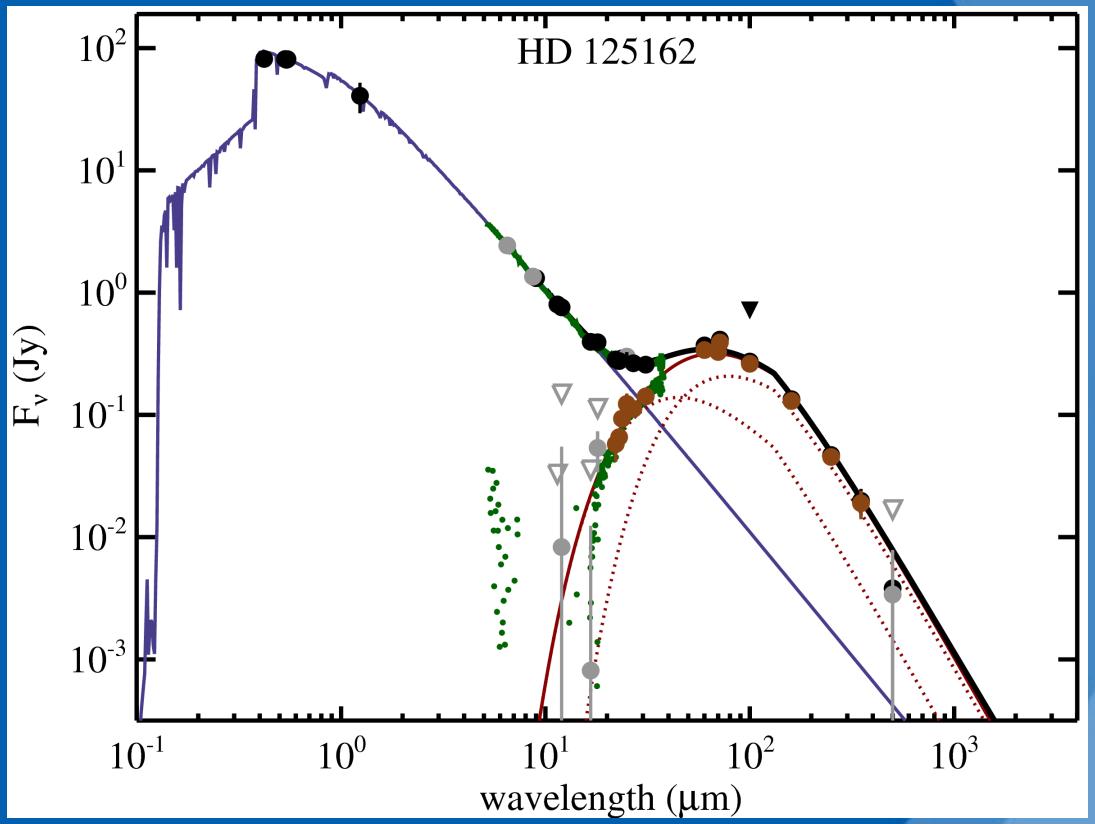
Refractory /
Dust Grains

Hypothesis: Preferential accretion of volatile gas from surrounding environment, over refractory dust, due to radiation pressure.

The Data

DEBRIS

- About 90 A-type stars observed by *Herschel* at 100/160 μm
- Best sensitivity to cold dust
- Characterizes turnover in SED
- Better resolution compared to other IR spacecraft
- Volume-limited sample selection of nearby stars

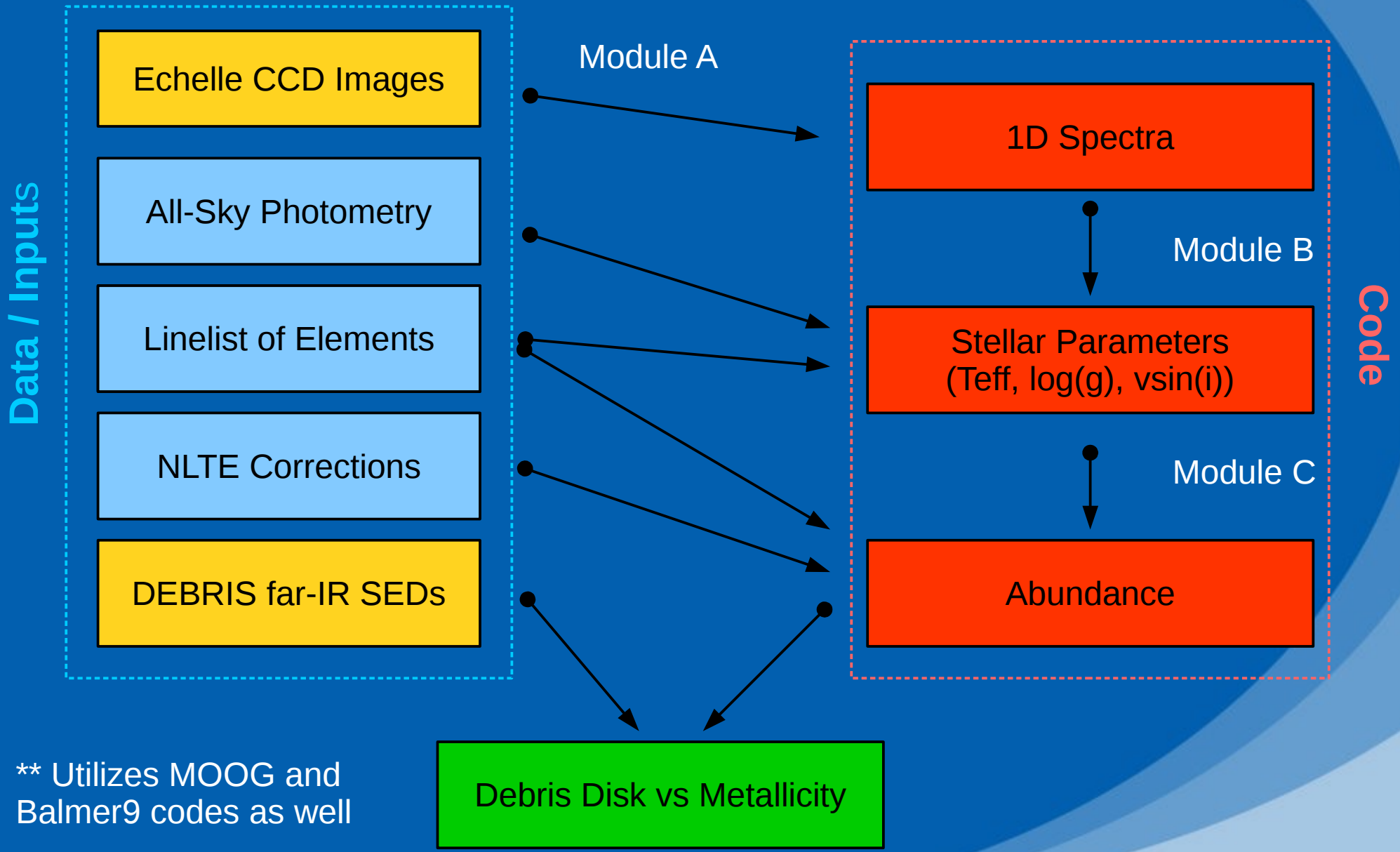


Collected Spectra

- 83 stellar spectra collected.
- Northern hemisphere spectra observed from McDonald Observatory in 4 nights.
- Southern hemisphere from ESO archive.
  - Many spectra seemingly unpublished.
- Goal to obtain most of the visible spectrum at R ~ 60000
- Species observed: Fe, Mg, C, O, Si, & Ti

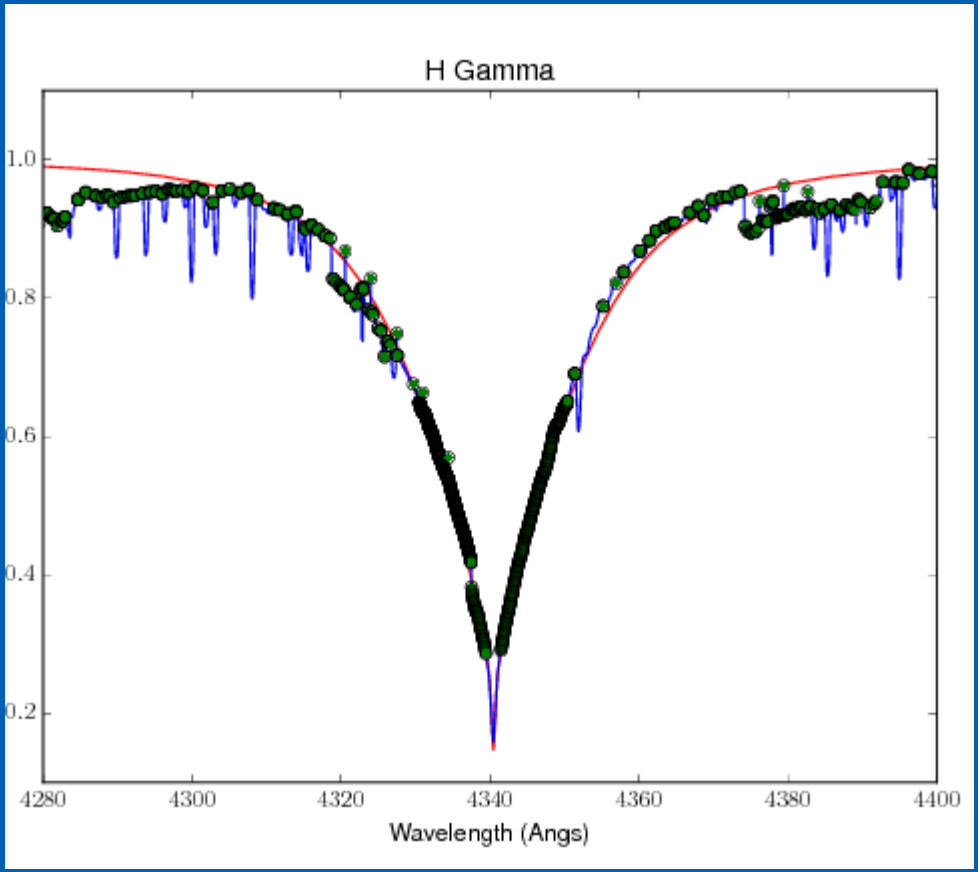
Spectral Analysis

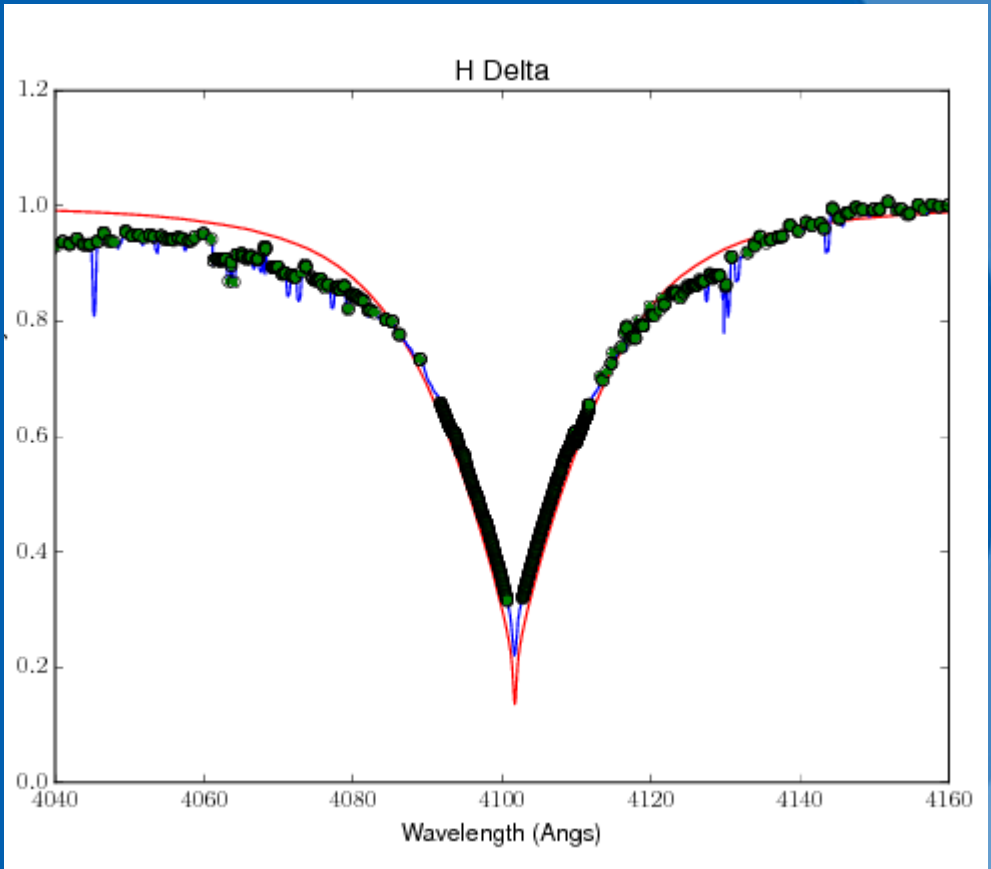
Stellar Reduction Pipeline



** Utilizes MOOG and Balmer9 codes as well

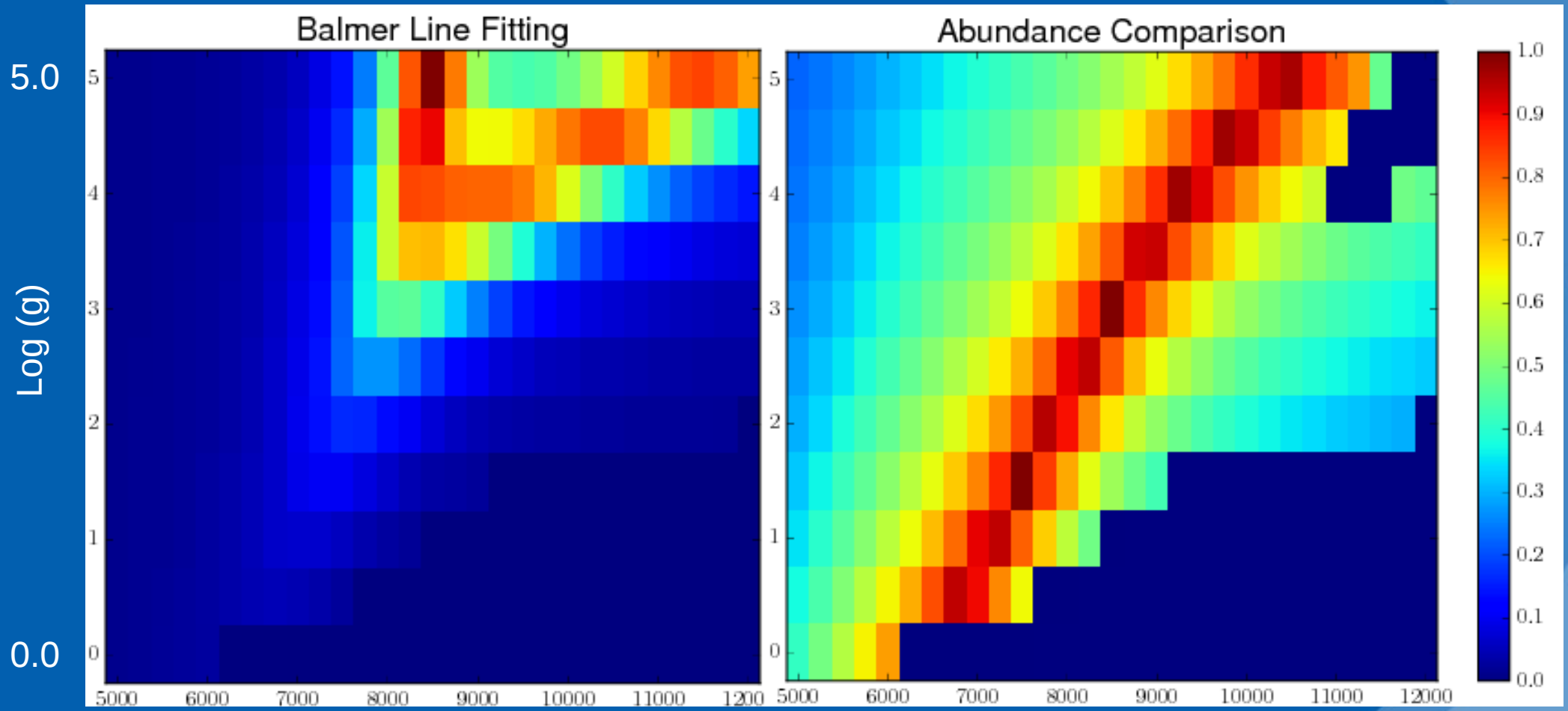
Balmer Line Fits





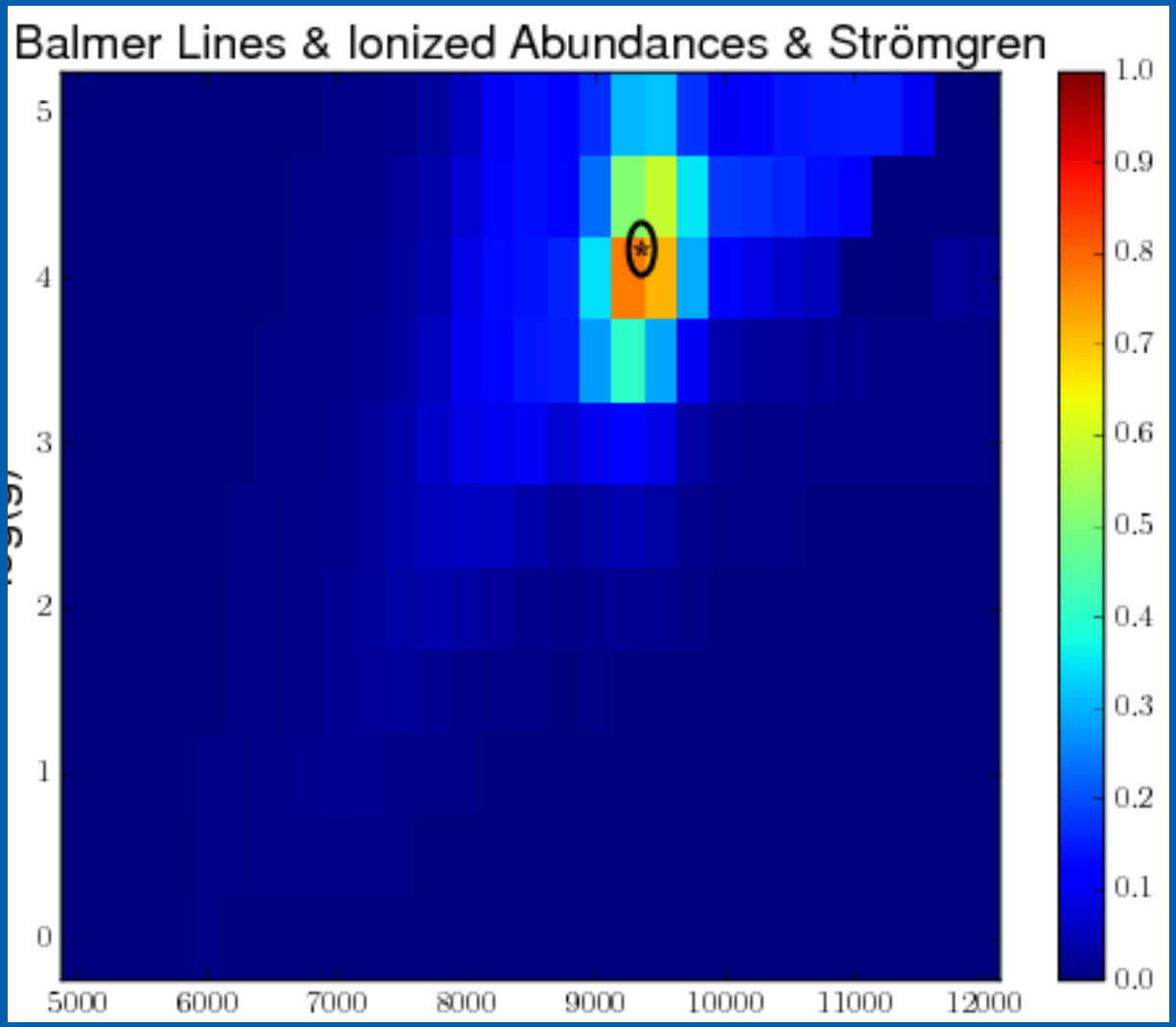
- 1st & 2nd derivative to find continuum vs metal lines
- Cross-correlation to get residual RV shift

Stellar Parameters



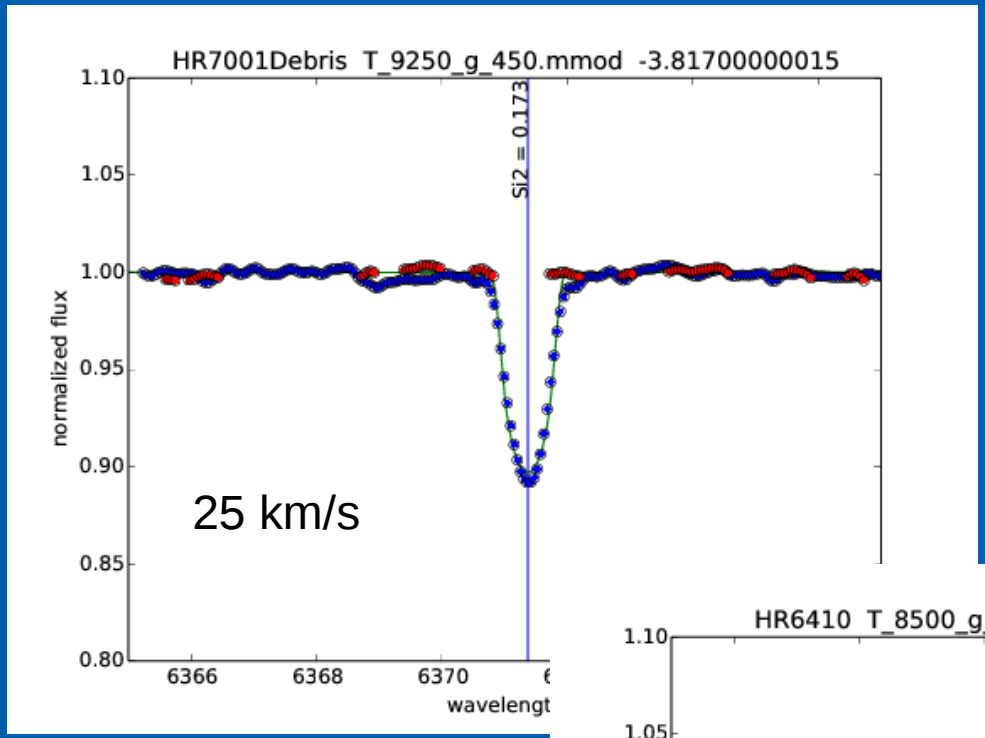
Module B

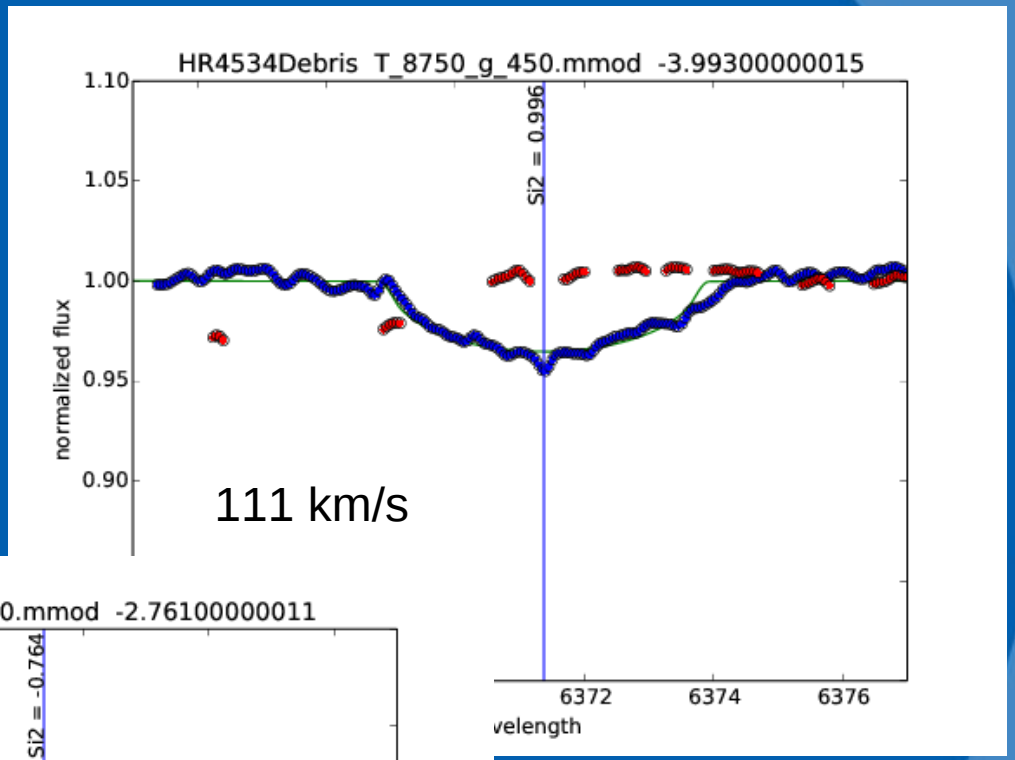
Stellar Parameters

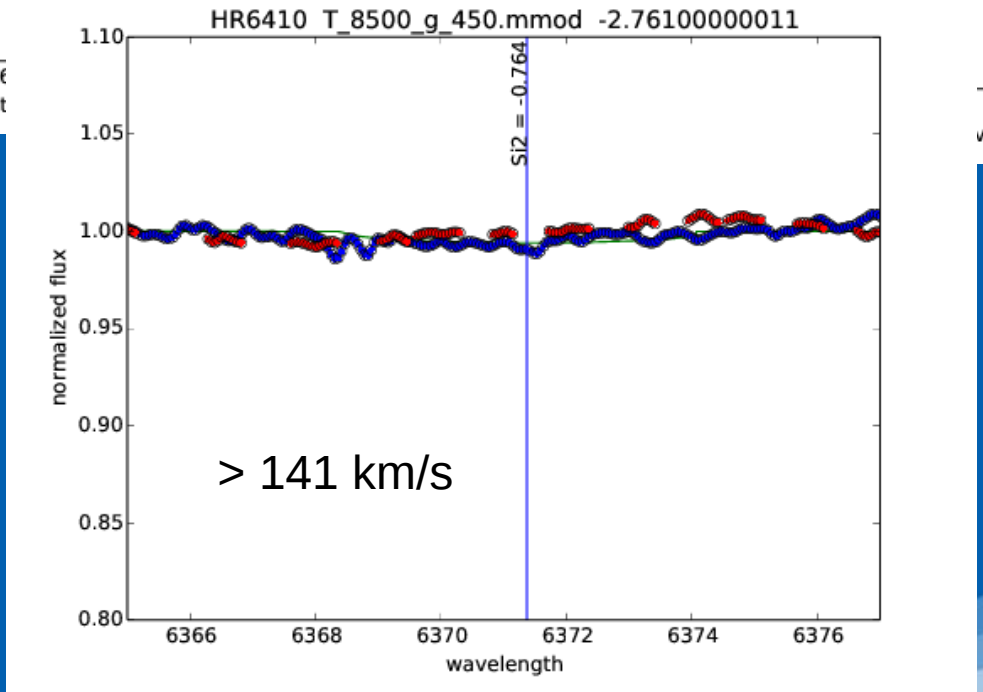


Module B

Synthetic Spectrum Fitting

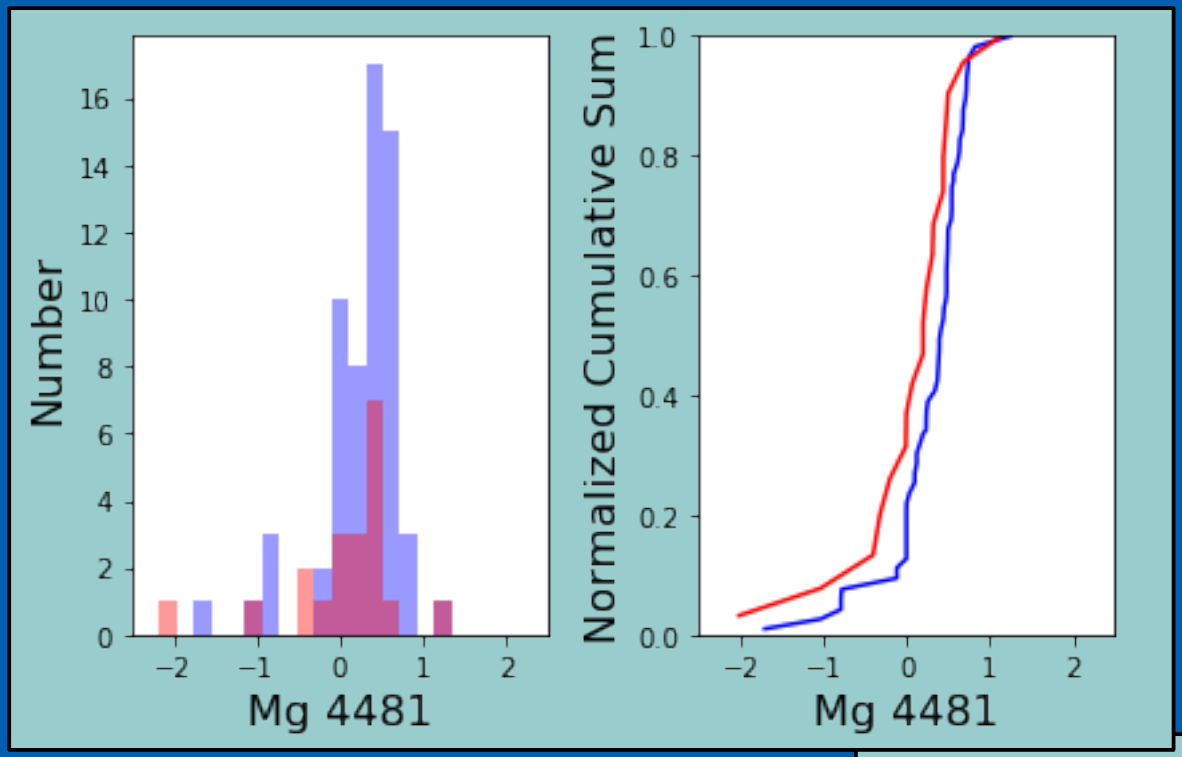






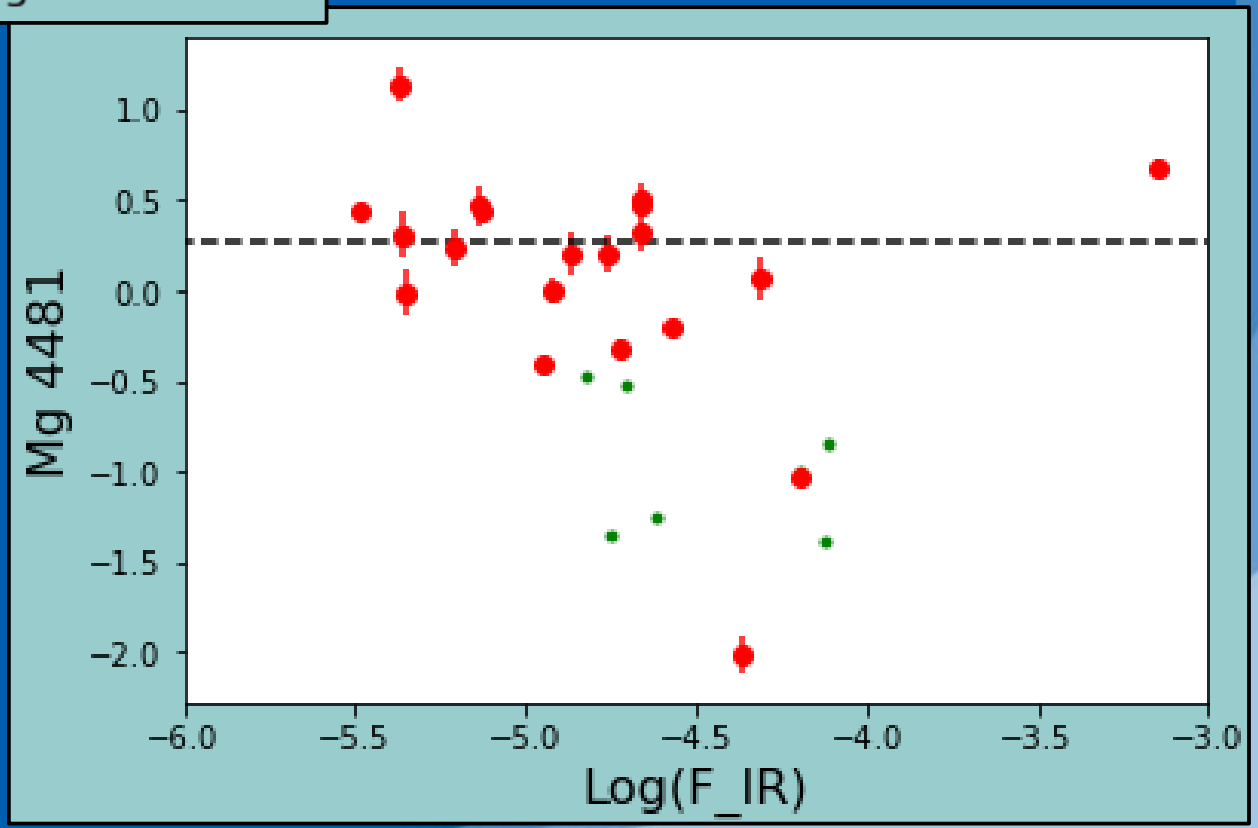
Module C

Results



Statistically relevant separation in KS test between disk vs no-disk samples.

Decline in Mg 4481 with fractional luminosity?



Importance?

If bright debris disks = refractory metal poor stars

Then validates Lambda Boo phenomenon as planet-disk interaction.

Knowns

~25% of A stars have debris disks

~2% of A stars are Lambda Boo

~10% of A stars with debris disks undergoing recent planet-disk interaction.

Global measure of exoplanetary stability.

Questions?